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"To the solid ground  
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

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#### CANCER AND ITS SUPPOSED CAUSES.

*Induced Cell-Reproduction and Cancer. The Isolation of the Chemical Causes of Normal and of Augmented Asymmetrical Human Cell-Division.* By H. C. Ross. Being the results of researches carried out by the author, with the assistance of J. W. Cropper. Pp. xxviii+291. (London: John Murray, 1910.) Price 12s. net.

MR. ROSS may be congratulated on having written a book singularly unlike most sober scientific treatises. He has been continually on the track of new things, and even the frontispiece, purporting to portray photographically a mitotic figure induced in a large lymphocyte, seems to have been inserted in order to embody a fresh discovery made after the rest of the book had gone to press, though whether others will attach the same significance to the photograph that Mr. Ross himself appears to do, the future will doubtless decide.

The book is written in an interesting and somewhat journalistic style, and the preface contains excellent autobiographical material designed, *inter alia*, to show how "a new method of experimentation with individual living human cells" was accidentally lighted on by the author.

Briefly, the method in question consists in concocting a jelly with agar, to which certain substances, including a dye, are added. Upon this jelly, films of blood containing living leucocytes are spread, which can thus be examined microscopically under various conditions. Ingenious devices for rapid photography are described, and considerable use is made of the photographs so taken in recording the results of observation.

A cytologist will find he has fallen into a rather strange environment when he gets immersed in Mr. Ross's book. He will have much to unlearn, and many new facts to assimilate, before he can hope to emulate the confident progress of his new leader. He will have to recognise that "the word 'nucleus' has a very vague meaning"; that chromosomes are not

really of nuclear origin, but that they originate from the Altmann granules, and are formed in the cytoplasm; that the nucleus forms the spindle and the nucleolus constitutes the centrosomic apparatus. He will probably also be astonished to hear that living cells have not hitherto been studied, and consequently that his own reminiscences of observations on *Ascaris* and many other animals' eggs, to say nothing of plants, in all of which he will seem to remember that nuclear divisions have been followed in the living cell, must be founded on delusion. The zoological investigator will further discover that he owes a larger debt than he was aware of to his botanical colleagues, for Mr. Ross tells us that "most cytological research has been carried out with plant-cells."

Mr. Ross thinks that "from the persistent examination of dead structures, cytology has been rather led away into a maze, from which it will be difficult to extricate it." The main task which he sets himself in his book is to perform this service of extrication and to show what can be accomplished by the study of the living cell in ascertaining the causes which underlie cell division, and especially of cell proliferation. The latter process is obviously of special importance, inasmuch as it lies at the root, not only of the ordinary processes of healing, but also, when it assumes an aberrant character, of malignant disease as well.

The new engine of research, the jelly method, is fully described, and one of the main objects in its use by the author was to control the rate of diffusion of different substances into the cell. There is an excursus on the problem of diffusion, and the net outcome is embodied in formulæ for making what Mr. Ross terms "coefficient" jelly, meaning thereby a jelly in which the rate of diffusion of stain, &c., can be related to a standard in which a particular rate is accepted as unity.

This jelly is made up of a 2 per cent. solution of agar, to which certain proportions ("units") of alkalis, salts, stains (commonly Unna's polychrome methylene blue), and other substances are respectively added. The "units" of each ingredient are so fixed that a doubling

of any one of them (*i.e.* two units) will double (or halve) the rate at which any particular substance, the action of which on the cell it is desired to study, will be absorbed. The method is a neat one, but it possesses obvious drawbacks, unless the separate action upon the cell of its constituents in the different strengths employed is fully known. The formulæ employed present an unfamiliar appearance, as the factors are all added together, and the inclusion amongst them of time- and heat-factors, on the basis of units composed of ten minutes and 5° C. respectively seems to assume unusual simplicity in the reactions involved.

By means of this method, however, depending largely on the entrance of the stain to the nucleus, many surprising results were obtained. The addition, for example, of various alkaloids, putrefactive products, &c., led the author to formulate far-reaching conclusions as to the causes underlying cell division, with the result that he believes himself to be justified in announcing the discovery of the main causes that bring about cell division, and induce cell proliferation. The causal agents in question are, of course, chemical, and probably most people who have paid any attention to the matter would agree with Mr. Ross that the fundamental causes of mitosis (nuclear division) are assuredly of a chemical nature. He thinks he has identified certain of these bodies, and this would constitute a most important addition to science if his views as to their action on the living cell should turn out to be as well founded as he imagines them to be.

It is, however, difficult to avoid scepticism on this very point, namely, as to whether the evidence on which the conclusions are drawn is really cogent, and whether the latter are themselves fully warranted.

The author might himself have contributed towards the solution of these crucial difficulties had he seen fit, in addition to the picturesque presentation of his results, to have subjected the foundations on which they rest to a full and wary criticism. For it is clear enough from the account actually given that the cells, even as they were being examined in the jelly, were moribund. It is stated, over and over again, that under the conditions of the experiments it was not easy to keep them alive for more than ten minutes. It is not, after all, very surprising to learn that all sorts of movements and distortions followed on the application of drugs like atropin, but it is at least uncommon to find that a mitosis can be completely carried through in three minutes. Numerous examples of alleged "mitosis" are described, and photographs are adduced in support of the descriptions. But the photographs themselves are singularly unconvincing, and suggest fragmentation or breaking up of the cell as a whole rather than anything one would expect to see in an actual cell- or nuclear-division. We fail to find any critical guard against misinterpretation of phenomena that might be due to osmotic differences or to the poisonous action of reagents employed.

Nor is one reassured by the account of mitosis (*i.e.* nuclear-division) as referred to in the book. The treatment of the whole subject is suggestive of the enthu-

siastic amateur who is simply unable, owing to temperament or lack of training, critically to check and examine his own work. Of course, we do not mean positively to assert that such is really Mr. Ross's position, but anyone who puts forward statements on mitosis such as appear on pp. 148 and 149, or again on p. 166, without producing the strongest and most convincing proofs, must not complain if in other directions his views fail to command unreserved acceptance. We are not at all surprised to learn that when Mr. Ross attempted to convince his friend of the soundness of his conclusions by demonstrating to them his preparations they all with one consent, as he himself avers, "began to make excuse."

It may be readily admitted that the book contains much that is interesting and valuable by way of suggestion, but we do not regard the conclusions of its author on cell-division and cell-proliferation as sufficiently well founded.

J. B. F.

#### THE EVOLUTION OF LUNAR DETAIL.

*Vergleichende Mond- und Erdkunde.* By Prof. S. Günther. Pp. xi+193. (Braunschweig: F. Vieweg und Sohn, 1911.) Price 5 marks.

THE resemblance which exists between the surface of the globe and that of the moon, as shown in the irregularities of level and the general character of the superficial formations, has long attracted attention, and much ingenious speculation has been exhibited in tracing a connection and seeking the cause. Fanciful theories exist without number, but men of the highest eminence have occupied themselves with the same theme, being led to it by the fascinating problem of the "Plurality of Worlds." This is the attraction that has induced Prof. Günther to study the subject, or, perhaps it would be more correct to say, to sift and examine what others have written about it. His book is a marvel of research and a triumph of industry. He seems to have examined all that has been written, whether in fact or fiction, bearing on the relations of earth and moon. Mr. H. G. Wells and Jules Verne represent one school of thought; Procter and Flammarion another; the highest authorities, as Darwin, Loewy, and Puiseux, form a third. Every page bristles with notes, and is encumbered by the author's commentaries on those notes. This arrangement perhaps shows greater power of collection than of assimilation. Much of the matter, if worth preserving, could have been incorporated in the text and made the book easier to read.

But however wide the outlook, whether in time or in nationality, problems connected with the physical constitution of inaccessible bodies are likely to remain unsettled, and the discussion prove barren of result. The history of this speculative inquiry is profoundly interesting, but from a philosophical and not an astronomical point of view. We are indebted to the author for the skill with which he has marshalled his facts and the enormous amount of information he has collected, but the moon seems little likely to contribute any fresh facts of importance to the main issue, since the probability in favour of similarity of structure and of evolutionary history is so great. By whatever pro-